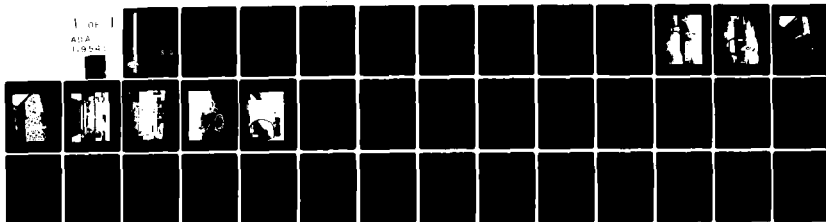


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Report 2359

VERIFICATION TESTS OF THE SOUTH COAST
TECHNOLOGY ELECTRIC VW RABBIT PICKUP TRUCK

by
Edward J. Dowgiallo, Jr.
and
Robert D. Chapman

April 1982

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U.S. ARMY MOBILITY EQUIPMENT
RESEARCH AND DEVELOPMENT COMMAND
FORT BELVOIR, VIRGINIA

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 2359	2. GOVT ACCESSION NO. AD-A119541	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) VERIFICATION TESTS OF THE SOUTH COAST TECHNOLOGY ELECTRIC VW RABBIT PICKUP TRUCK		5. TYPE OF REPORT & PERIOD COVERED Verification Test 20 Sep to 16 Oct 81
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Edward J. Dowgiallo, Jr. Robert D. Chapman		8. CONTRACT OR GRANT NUMBER(s) Interagency Agreement EC-77-A-31-1042
9. PERFORMING ORGANIZATION NAME AND ADDRESS Electrochemical Div, Electric Power Lab, DRDME-EC; U.S. Army Mobility Equipment Research and Development Command; Fort Belvoir, VA 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Mobility Equipment Research and Development Command, ATTN: DRDME-EC; Fort Belvoir, VA 22060		12. REPORT DATE April 1982
		13. NUMBER OF PAGES 34
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) US Department of Energy Electric and Hybrid Highway Vehicle Systems Program Division of Transportation Energy Conservation Washington, DC 20585		15. SECURITY CLASS. (of this report)
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Electric Vehicle Traction Batteries Electric Motor Controller Charger		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The South Coast Technology Electric is a standard VW Rabbit pickup truck that has been converted to an electric vehicle. It is powered by 18 6-V batteries connected in series through a transistorized field chopper controller to a 24-hp shunt-wound d.c. motor. It has a 4-speed manual transmission, disc brakes in front, drum brakes in the rear, and regenerative deceleration. It comes with an off-board 230-V a.c. charger with a 30-A maximum current rating.		

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PREFACE

This report was prepared to document work sponsored by the United States Government. Neither the United States, nor its agents, the United States Army, nor any Federal employees, nor any of their contractors, subcontractors, or their employees, make any warranty, expressed or implied, or assume any legal liability to responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately-owned rights.

The views, opinions, and findings contained in this report are those of the authors and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

This vehicle was tested to determine its conformity to the Department of Energy (DOE) "Performance Standards for Demonstration" (Appendix A). The results reported herein show the nominal capability of the vehicle when the standards are exceeded or the maximum capability of the vehicle when it failed to meet the standards. The vehicle may exceed the performance reported herein in actual use. It may also have safety features and amenities not required by the Department of Energy Standards.

Mr. Michael E. Johnson, P.E. of V.S.E. Corporation was responsible for aspects of calibration of the signal conditioning circuits and recording instruments as well as data tabulations and plotting.

Messers James A. Queen and Aubrey Thomas of the Environmental and Field Division, Production Assurance and Testing Directorate, MERADCOM, assisted in data collection and vehicle operation.



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VERIFICATION TESTS OF THE SOUTH COAST TECHNOLOGY

ELECTRIC VW RABBIT PICKUP TRUCK

I. SUMMARY

The Electric by S.C.T./VW Rabbit Pickup truck, modified by South Coast Technology Incorporated of Ann Arbor, Michigan, was tested during the period from 20 September to 16 October 1981. Complete test results are contained in Section V of this report; part of the verification test results are summarized below:

Acceleration: 0-50 km/h (31.1 mi/h) in 13.1 s.

Range: SAE J227a cycle "B" on level (\pm 1-percent) terrain yielded 68.2 km (42.4 mi) and 210 cycles.

Forward Speed Capability: Forward speed of 75 km/h (46.6 mi/h) was maintained for more than 5 min on the level (\pm 1-percent) portion of the MERADCOM test track.

Gradeability at Speed: At 25 km/h (15 mi/h) the vehicle can traverse a 15.3-percent grade based on calculations from acceleration tests.

Gradeability Limit: Calculations based on drawbar-pull tests indicate a 30.7-percent forward and a 28.2-percent reverse gradeability for at least 20 s.

II. INTRODUCTION

The Electric VW Pickup Truck by S.C.T. was tested to determine conformity to the Department of Energy (DOE), "Performance Standards for Demonstrations," published in the Federal Register, 12 February 1980. The results of the testing performed by MERADCOM and other descriptive data concerning the vehicle are presented in this report.

III. OBJECTIVES

The objectives of the tests were to examine the Electric by S.C.T. for suitability of those aspects of vehicle and component operating characteristics as outlined by the DOE "Performance Standards for Demonstrations."

IV. TEST VEHICLE DESCRIPTION

The South Coast Technology Electric is a Volkswagen Rabbit pickup truck which has been converted to an electric vehicle (Figures 1 and 2). The pickup has a wheelbase of 2.6 m (103.3 in.), is 4.3 m (171.7 in.) long, and 1.6 m (64.8 in.) wide. It has a curb weight of 1482 kg (3260 lb), can carry a payload of 272 kg (600 lb) and has a gross vehicle weight of 1891 kg (4160 lb) which includes a passenger and a driver. The vehicle is powered by 18 6-V lead batteries connected in series (Appendix B). The batteries are configured as two modules, one containing 6 batteries and the other containing the remaining 12. The modules are normally located beneath the bed of the pickup; however, for ease of access during testing, it was necessary to place them in the bed of the vehicle (Figures 3 and 4). The transistorized field chopper controller (manufactured by EHV systems) is located under the hood of the pickup (Figure 5 and Appendix B).

The vehicle is driven by a 24-hp shunt-wound d.c. motor (manufactured by Siemens) located beneath the controller in the front of the vehicle (Figure 6). The transmission is a manual 4-speed synchro mesh mated with the traction motor. The chassis has been modified slightly with longitudinal reinforcement and additional gusseting. The suspension system is standard Volkswagen, with struts in the front and leaf springs in the rear. The pickup has power-assisted disc brakes in the front and drum brakes in the rear and is equipped with steel-belted radial tires inflated to 248.2 kPa (36 lb/in.²). It also has regenerative deceleration. The off-board charger (manufactured by Lester) is rated at 230 V with a peak current of 30 A (Figure 7).

The vehicle comes with windshield wipers and washers, fuel guage, speedometer, odometer, and ammeter as standard equipment. In addition, it has a tachometer and a state-of-charge meter (Figure 8). The heater defroster is a diesel-fired unit (made by Espar) rated at 10,000 Btu/h.

V. TEST RESULTS

The following are the test results of the verification performed at MERADCOM during the period of 20 September to 16 October 1981. Paragraphs are referenced to the DOE "Performance Standards for Demonstration" criteria. See Appendix C for verification procedures.



Figure 1. Front of the Electric VW Pickup Truck by S.C.T.



Figure 2. Rear of the Electric VW Pickup Truck by S.C.T.

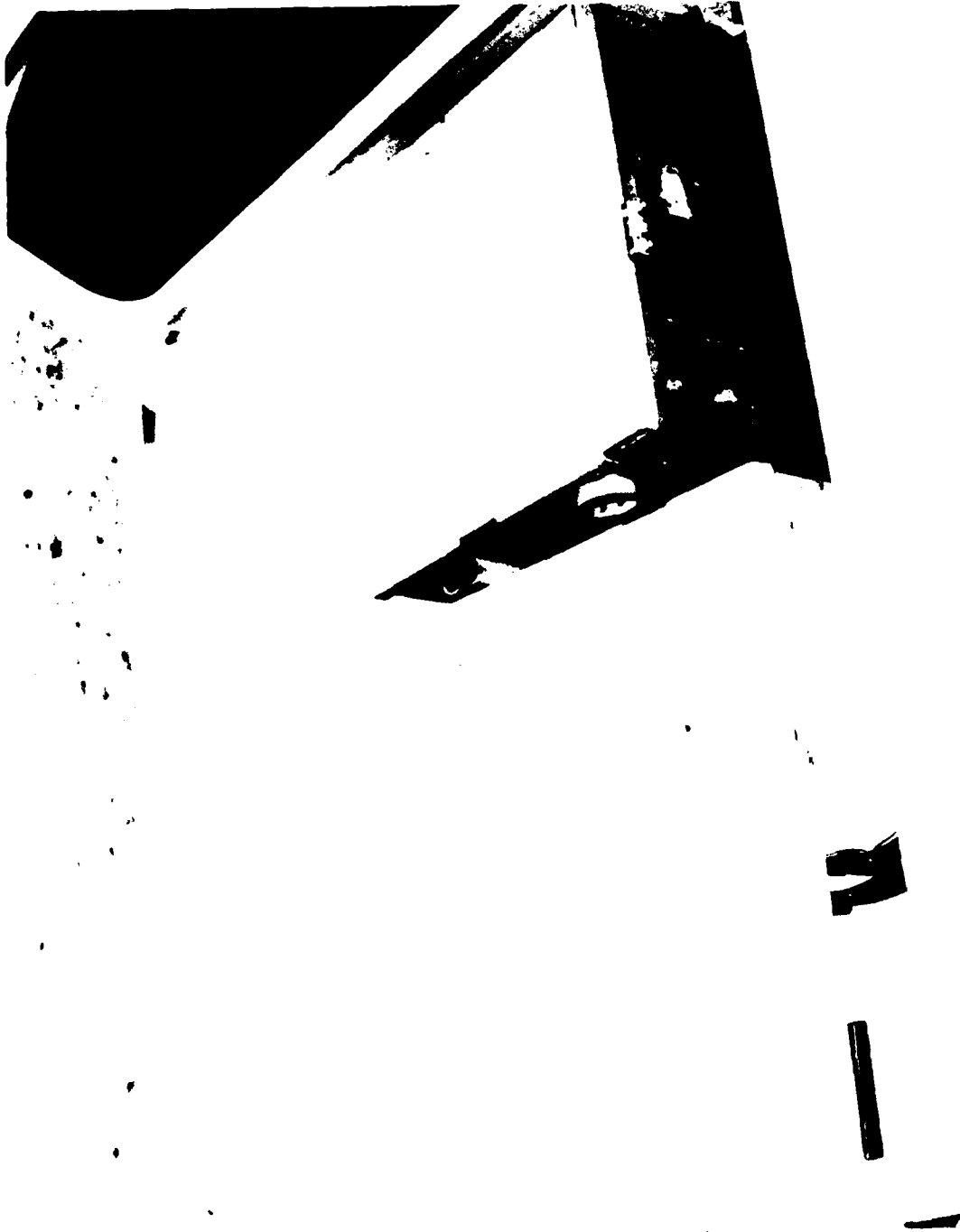


Figure 3. Traction Battery Modules (Covered).

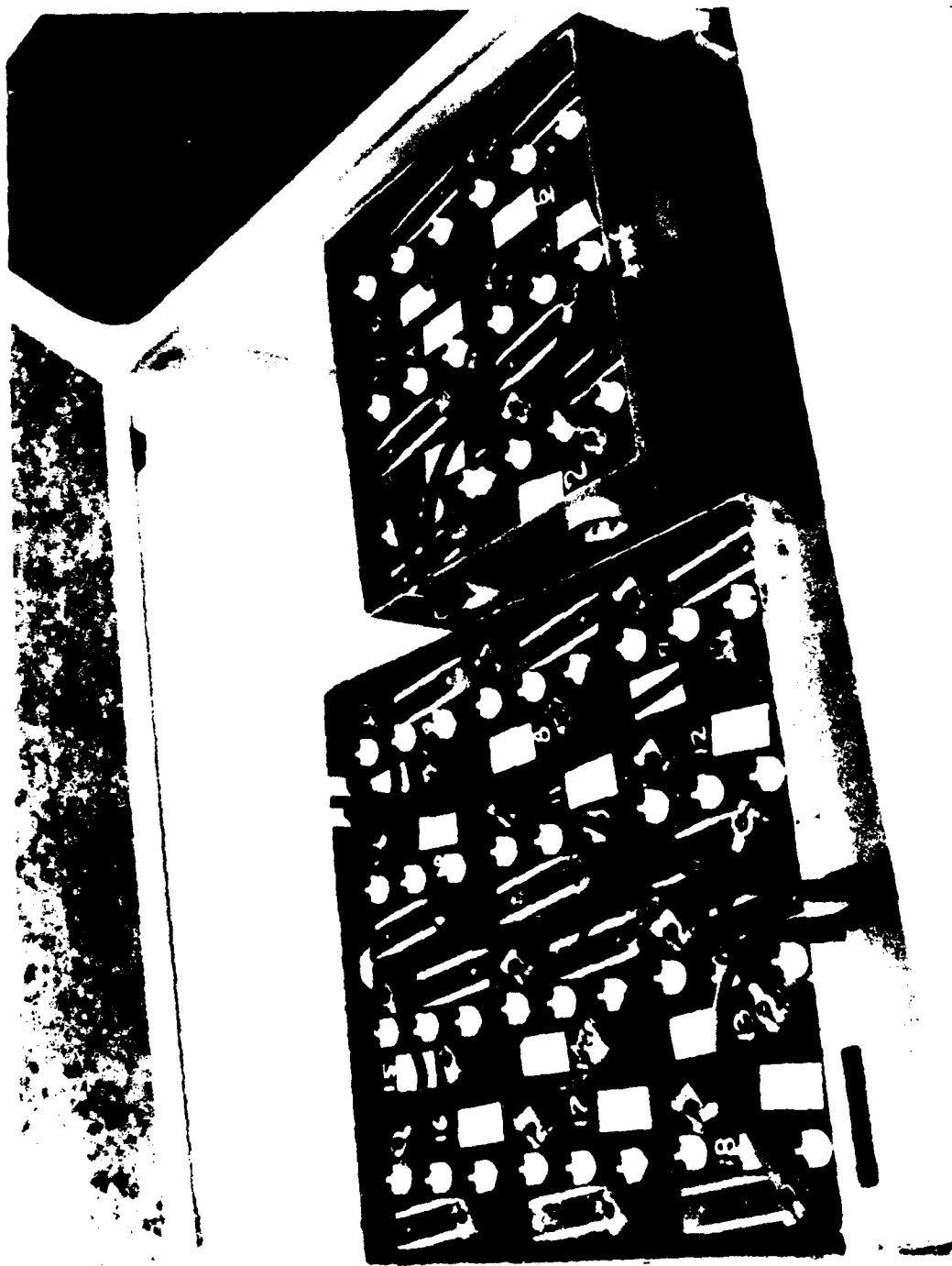


Figure 4. Traction Battery Modules (Open).

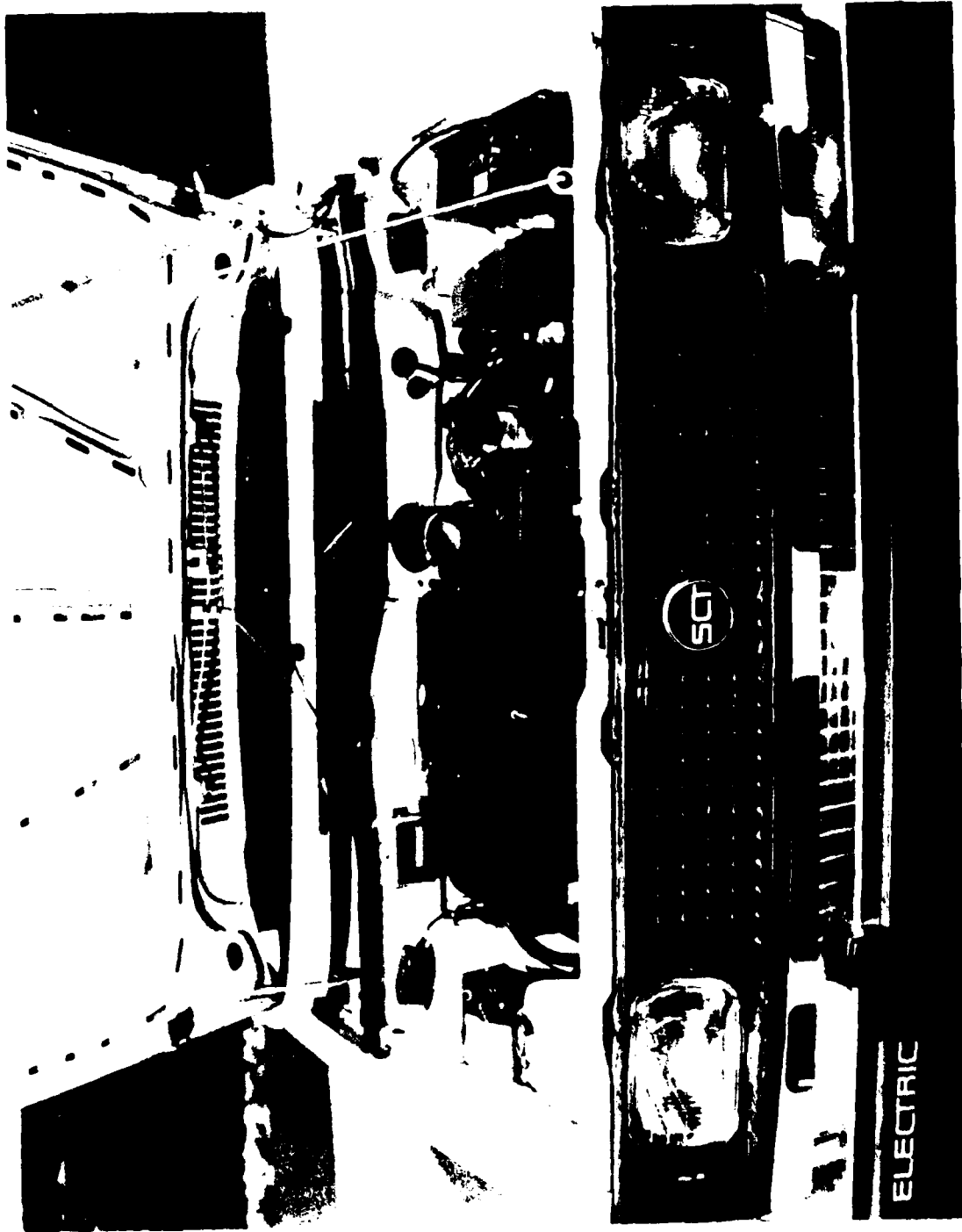


Figure 5. Transistorized Field Chopper Controller.

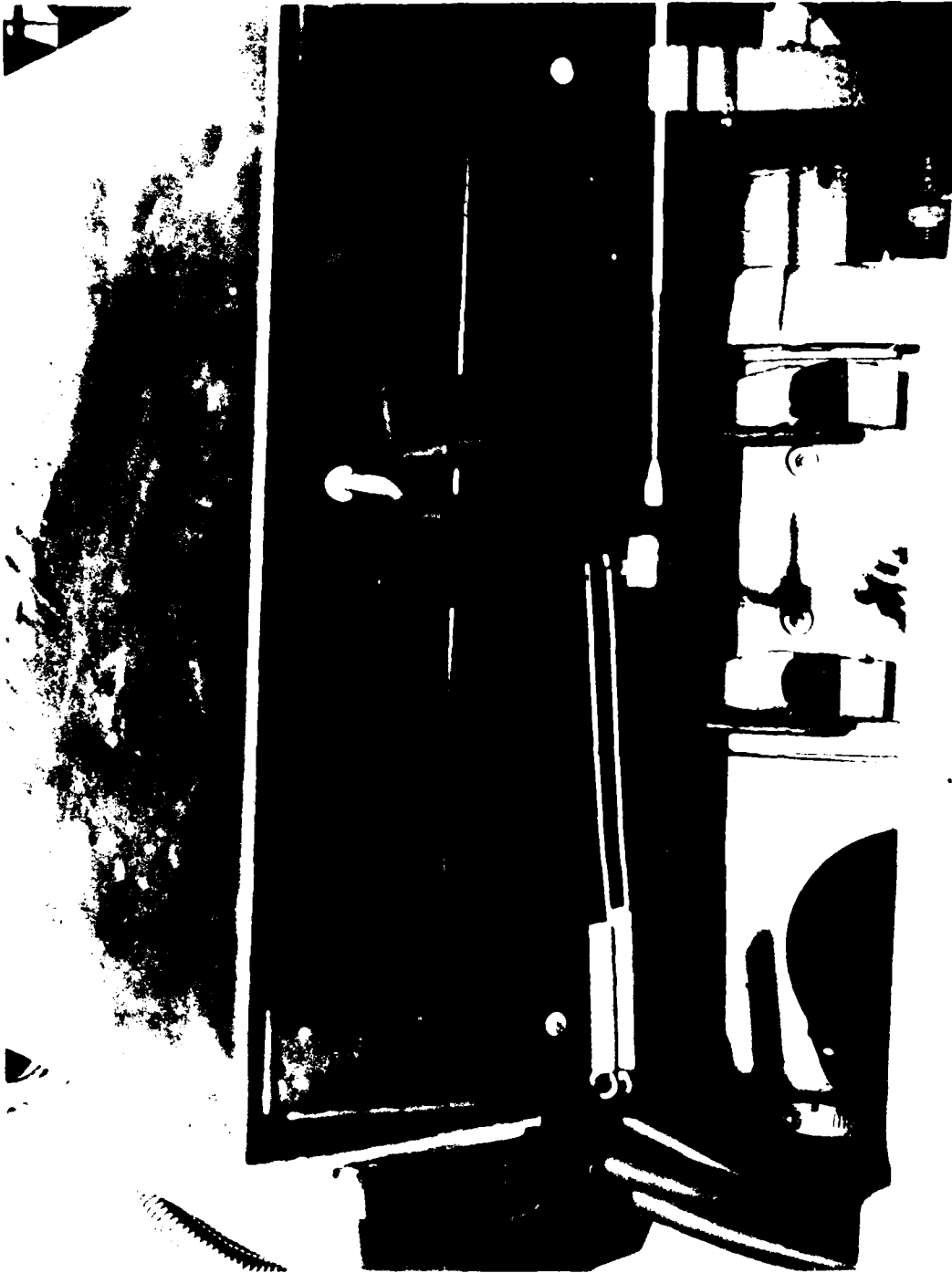


Figure 6. Traction Motor, 24-hp.



Figure 7. Offboard Battery Charger.



Figure 8. Instrument Panel of the Electric VW Pickup Truck by S.C.T.

475.11 (a) Acceleration: 0-50 km/h (31.1 mi/h) in 13.1 s.

(b) Gradeability at Speed: At 25 km/h (15 mi/h) the vehicle can traverse a 15.3-percent grade based on results of acceleration tests.

(c) Gradeability Limit: Calculations based on drawbar-pull tests indicate a 30.7-percent forward and a 28.2-percent reverse gradeability for at least 20 s.

(d) Forward Speed Capability: Forward speed of 75 km/h (46.6 mi/h) was maintained for more than 5 min on the level (\pm 1-percent grade) portion of the MERAD-COM test track.

(e) Range: SAE J227a cycle "B" on level (\pm 1-percent) terrain, yielded 68.2 km (42.4 mi) and 210 cycles.

(f) Battery Recharge Time: After an 80-percent discharge, recharged for 10 h with off-board 230-V, 30-A charger; after recharge the vehicle exceeded the minimum range requirement of 60 km (37.3 mi) (80-percent discharge was determined by driving the vehicle in an SAE J227a cycle "B" mode to 80-percent of minimum range requirement).

(g) Recharge Control: Tapering voltage comparator.

(h) Energy Consumption: The only nonelectric energy used is the diesel-fired comfort heater (see (1)).

(i) Battery:

(1) Warranty: 180 days unconditional; prorated remainder of year by the battery manufacturer (1-yr umbrella warranty by vehicle manufacturer).

(2) Type: Exide XPV-23-3.

(3) Capacity: 156 Ah (125 min at 75 A).

(4) Voltage: 108 V (18 6-V batteries connected in series).

(j) State-of-Charge Meter: The vehicle is equipped with a color-coded state-of-charge meter which shows the remaining capacity of the batteries based on battery voltage.

(k) Odometer: The vehicle is equipped with an odometer.

(l) Passenger Comfort Heater: Diesel-fired unit (made by Espar) rated at 10,000 Btu/h.

(m) Documentation: Maintenance manual, operators manual, and electrical schematics were submitted with vehicle, but no parts list was included.

(n) Emissions: Did not evaluate.

(o) Safety, etc.: The Department of Transportation (DOT) is performing these evaluations. However, MERADCOM performed the following limited checks for design intent:

(1) Electrical Isolation: The electrical propulsion system is isolated from the vehicle chassis.

(2) Safety Standards 208 and 301: DOT will check compliance.

(3) Battery Caps: Standard golf-cart-industry type. Flame-barrier characteristics were not tested.

(4) Ventilation of Battery Compartments: The battery compartments are vented by a 100-ft³/min fan which forces air over the batteries at a rate sufficient to change the air 25 times/min. This fan operates while charging and when the vehicle is operating.

(5) Battery Emergency Disconnect: The vehicle is equipped with a manual transmission and the propulsion motor can be disconnected from the mechanical drive system by depressing the clutch.

(6) Parked Temperature Effect: The vehicle was parked for 8 h at each of the temperatures -25° C and +50° C. Subsequent operation at each of those temperatures revealed no apparent damage to the vehicle or hazard to persons.

VI. CHRONOLOGY OF VEHICLE FAILURES AND CORRECTIVE ACTIONS

No significant failures occurred.

APPENDIX A

PERFORMANCE STANDARDS FOR DEMONSTRATIONS

FEDERAL REGISTER 12 FEBRUARY 1980 PART IV, SUBPART B

475.11 Minimum levels of performance for commercial vehicles.

The following minimum levels of performance are required with respect to any commercial vehicles purchased or leased in fulfillment of contracts entered into following the effective date of these regulations, pursuant to section 7(c) of the Act.

(a) Acceleration: The time required to accelerate from rest to 50 km/h shall not exceed 14 s for vehicles with a payload-carrying capability of less than or equal to 600 kg.

(b) Gradeability at speed: The grade which can be traversed up at 25 km/h shall be at least 10 percent.

(c) Gradeability limit: The grade which the vehicle can start and climb for 20 s either backward or forward shall be no less than 20 percent.

(d) Forward speed capability: The speed which can be maintained for 5 min shall be 75 km/h.

(e) Range: The distance which the vehicle can be operated with vital accessories on or equivalent shall be:

(1) For an electric vehicle, at least 60 km on the SAE J227a/B cycle,

(2) For an hybrid vehicle, at least 200 km on the SAE J227a/B cycle.

(f) Battery recharge time: The vehicle shall be capable of satisfying the range requirement of section 475.11(e), above, after being recharged for no more than 10 h. At the start of this recharge, the vehicle shall have 80-percent discharged batteries as specified by the vehicle test conditions and procedures of section 475.3.

(g) Recharge control: The vehicle shall have an automatic recharge control which will meet the requirements of energy, life, and safety as such requirements are stated by these performance standards. This paragraph applies when on-board chargers are used and also when offboard chargers supplied by or specified by the vehicle manufacturer for recharge of the vehicle are used.

(h) Energy Consumption:

(1) For an electric vehicle, the maximum amount of nonelectrical energy consumed shall be that used for operation of the accessories only.

(2) For a hybrid vehicle, nonelectrical energy consumed shall not exceed 9.8 kJ/kmkg of cargo and shall also not exceed 75 percent of total energy consumed for propulsion and vital accessories, based on being fully loaded on a driving schedule of 100 km on SAE J227a/B cycle, the cargo not including the operator, and with vital accessories on.

(i) Battery life:

(1) The vehicle shall be capable of at least 75 percent of the range specified in section 475.11(e) after 12 mo or 15,000 km of normal use, whichever occurs first.

(2) The vehicle shall be capable of 100 percent of the acceleration and gradeability specified in section 475.11(a), (b), and (c) for all test conditions and procedures specified by section 475.3 for 12 mo or 15,000 km of normal use, whichever occurs first.

(3) The batteries shall, if necessary, be repaired or replaced by the vehicle manufacturer at no cost to the user of the vehicle in order to meet requirements of (1) and (2) of section 475.11(i).

(j) State-of-charge meter: The vehicle shall have a state-of-charge meter for the propulsion battery system or other means of providing an indication of remaining range.

(k) Odometer: The vehicle shall have an odometer.

(l) Passenger comfort heater: The vehicle shall have the capability for having a passenger comfort heater installed at the option of the purchaser.

(m) Documentation: Adequate user manuals, maintenance (service) manuals, and parts lists shall be provided.

(n) Emissions: The vehicle shall comply with all applicable Federal emissions regulations for motor vehicles.

(o) Safety, crashworthiness, damageability, crash avoidance, and hazards:

(1) The vehicle shall comply with all applicable Federal motor vehicle safety standards as set forth in 49 CFR Part 571, unless a temporary exemption is obtained by the manufacturer from the Department of Transportation.

(2) Until the Department of Transportation issues regulations which cover the same subjects, the vehicle shall also have the following performance characteristics:

(i) The electric propulsion circuit shall be electrically isolated from other conductive portions of the vehicle sufficiently to prevent personal hazards due to contacting any portion of the electric propulsion circuit while in contact with other portions of the vehicle.

(ii) The vehicle shall be capable of complying with their performance requirements of Federal motor vehicle safety standards 208 and 301 with all battery materials remaining outside the passenger compartment.

(iii) Vehicles with battery vents shall have flame-barrier provisions to inhibit battery explosions.

(iv) Ventilation shall be adequate within the battery compartment to maintain the concentration of hydrogen below 4 percent by volume during vehicle operation (including charging and maintenance).

(v) The vehicle shall have a device which provides for the positive disconnection of the battery and which is operable from the normal operator position.

(vi) The vehicle shall be capable of being parked for up to 8 h in temperatures of -25°C to $+50^{\circ}\text{C}$ and subsequently operated by moving forward under its own power at any temperature within this temperature range without damage to the vehicle or hazards to persons.

APPENDIX B

VEHICLE SUMMARY DATA SHEET

1. VEHICLE MANUFACTURER:

South Coast Technology, Inc.
793 Airport Blvd
Ann Arbor, Michigan 48104
Phone: (313) 995-2187

2. VEHICLE DESCRIPTION:

Name: Electric by S.C.T.
Model: Pickup
Availability: 60 days A.R.O.
Model Pickup
Price: \$17,000 (10-20-81)

3. VEHICLE WEIGHT:

Curb Wt: 1482 kg (3260 lb)
Driver Wt: 68 kg (150 lb)
Gross Wt: 1891 kg (4160 lb)
Passenger Wt: 68 kg (150 lb)
Payload Wt: 272 kg (600 lb)

4. VEHICLE SIZE:

Wheelbase: 2.6 m (103.3 in.)
Headroom: 0.9 m (37 in.)
Length: 4.3 m (171.7 in.)
Width: 1.6 m (64.8 in.)
Legroom: 1.0 m (40 in.)

5. AUXILIARIES & OPTIONS:

No. Lights: 14

Type and Function: Illumination

- a. Headlights (2)**
- b. Taillights (2)**
- c. Parking Lights (2)**
- d. Back-up (2)**
- e. License Plate (2)**
- f. Directional (4)**

Windshield Wipers: Yes

Windshield Washers: Yes

Defroster: Yes

Heater: Yes

Radio: No

Fuel Gage: Yes

Ampmeter: Yes

Tachometer: Yes

Speedometer: Yes

Odometer: Yes

No. Mirrors: 2

Power Steering: No

Power Brakes: Yes

Transmission Type: 4-Spd Manual

Rear Ratios: 1st 3.45:1; 2nd 1.94:1; 3rd 1.29:1; 4th 0.91:1; Rev: 3.17:1

6. PROPULSION BATTERIES:

Type: Lead-Acid

Manufacturer: EXIDE

No. of Modules: 18

Model: XPV-23-3

No. Cells: 54

Battery Voltage: 108

Ah Capacity: 156

Module Size: .26 m x .18 m x .28 m

(10-3/8 in. x 7-3/16 in. x 11 in.)

Module Wt: 30 kg (66 lb)

Battery Rate: 125 min @ 75 A

Battery Cycles: N/A

7. AUXILIARY BATTERY:

Type: Lead-Acid
Manufacturer: SEARS
No. Cells: 6
Battery Voltage: 12
Ah Capacity: 65 Ah
Battery Size: .18 m x .30 m x .21 m
(7 in. W x 12 in. L x 8¼ in. H)
Battery Rate: 20 h
Battery Wt: 28 kg (62 lb)

8. CONTROLLER:

Type: Field Chopper
Manufacturer: EHV Systems
Voltage Rating: 108 V
Current Rating: 400 A
Size: .38 m x .51 m x .15 m
(15 in. x 20 in. x 6 in.)
Weight: 14.5 kg (32 lb)

9. PROPULSION MOTOR:

Type: Shunt
Manufacturer: SIEMENS
Insulation Class: F
Voltage Rating: 130 V
Current Rating: 150 A
Size: 4.2 m x 5.5 m
(13.8 in. D x 17.9 in. L)
Weight: 88 kg (195 lb)
Rated Speed: 2200 r/min
Max. Speed: 6700 r/min

10. BODY:

Type: Pickup
Manufacturer: VW
No. Doors: 2
Type: Hinged, Swing-out

No. Windows: 6
Type: 4 fixed, 2 wind-up
No. Seats: 2
Type: Bucket
Cargo Volume: .95 m³ (33.3 ft³)
Cargo Dimensions: 1.8 m x 1.3 m x .4 m
(72 in. L x 52 in. W x 15½ H)

11. CHASSIS:

Type Frame: Unitized
Manufacturer: VW
Type Material: Steel
Modifications: Longitudinal reinforced and additional gusseting
Type Springs: Struts/Front, Leaf/Rear
Type Shocks: Hydraulic
Axle Type Front: Std VW
Axle Type Rear: VW Modified by S.C.
Axle Manufacturer: VW
Drive Line Ratio: 3.9.1
Type Brakes, Front: Disc
Type Brakes, Rear: Drum
Regenerative Deceleration: Yes
Tire Type: Radial
Manufacturer: Firestone
Size: P205/70R13
Pressure: 248.2 kPa (36 lb/in.²)
Rolling Radius: .30 m (11.7 in.)

12. BATTERY CHARGER:

Type: Ferro Resonant
Manufacturer: Lester
On- or Off-Board: Off
Input Voltage: 230/110 V
Peak Current: 30/15 A
Recharge Timer: None
Size: .27 m x .38 m x .23 m
(10.5 in. x .5 in. x 9 in.)
Weight: 16 kg (35 lb)
Automatic Turnoff: Yes

APPENDIX C

ELECTRIC AND HYBRID VEHICLE VERIFICATION PROCEDURES

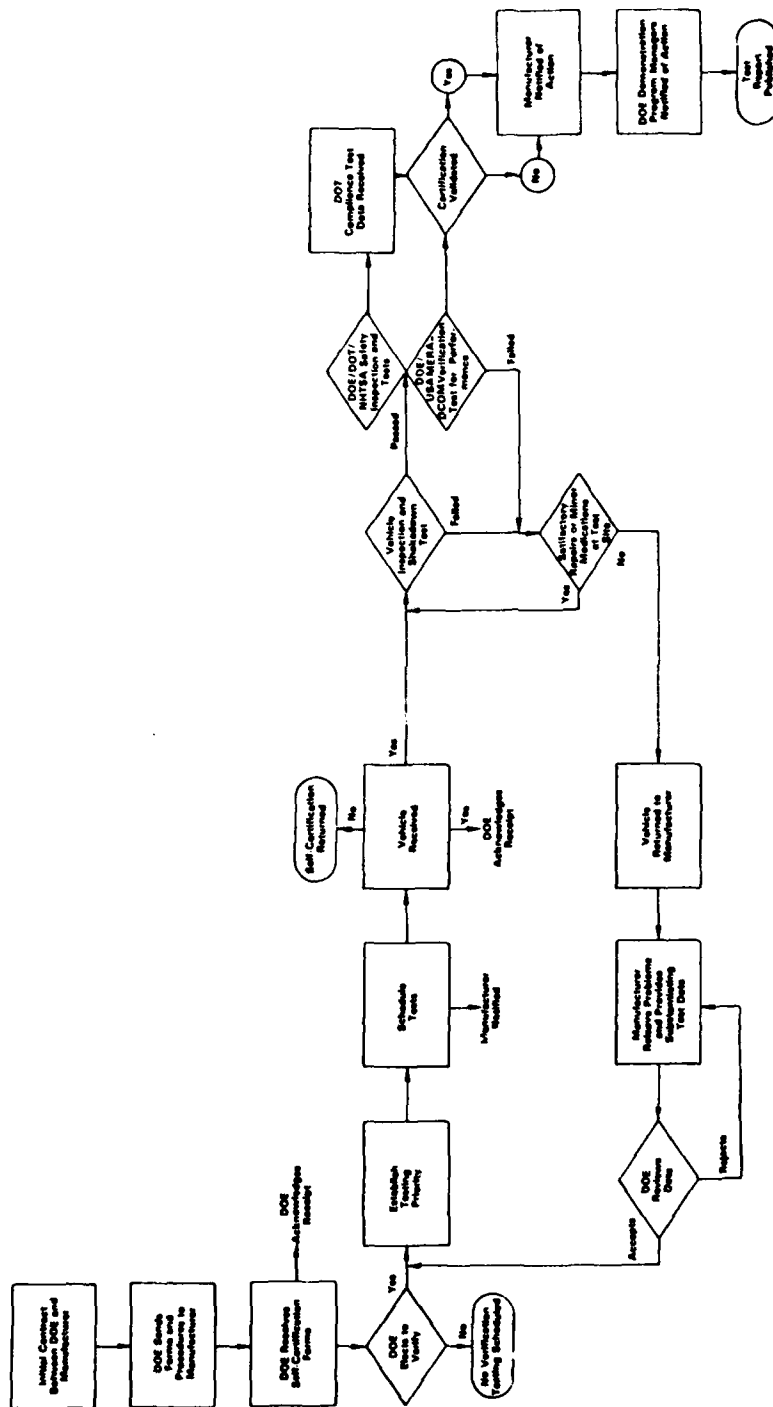
BACKGROUND

DOE is required by Public Law 940413 to issue performance standards for vehicles used in the Electric and Hybrid Vehicle (EHV) Market Demonstration. On 30 May 1978, DOE published a final rule in the Federal Register (Vol. 43, No. 104) promulgating the first Performance Standards. This rule was effective on 3 July 1978 and prescribed minimum performance standards for electric and hybrid vehicles to be purchased or leased for the first phase of a demonstration program under the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976. Performance Standards are updated from time to time and the current rule was published in the Federal Register on 12 February 1980 (Vol. 45, No. 30).

Manufacturers who certify that their vehicles meet the latest requirements of the DOE Performance Standards may offer those vehicles for the DOE Market Demonstration Program. DOE reserves the right to verify, by independent test, the manufacturer's self-certification. The test procedures for DOE performance tests are based on SAE Test Procedure J227a. Safety inspection and testing services are provided by the Department of Transportation/National Highway and Traffic Safety Administration (DOT/NHTSA) through an interagency agreement. Performance testing is performed by the U.S. Army Mobility Equipment Research and Development Command through an interagency agreement. During verification testing, vehicle component or subsystem failures will be immediately brought to the attention of the manufacturer. Repeated or multiple component or subsystem failures experienced during test are grounds for invalidating the self-certification of the vehicle for purposes of the DOE Market Demonstration Program.

CERTIFICATION PROCESS

A manufacturer can certify an existing vehicle as meeting the DOE standards (which include applicable NHTSA safety standards by reference) at any time by submitting a letter of certification and providing the required data on the vehicle to the Department of Energy Director of Electric and Hybrid Vehicles Division or his designee (see chart on following page for certification and verification procedures).



Electric and Hybrid Vehicle Self-Certification and Verification Procedures

VERIFICATION PROCESS

- DOE-Sponsored Performance Tests by the U.S. Army MERADCOM.
- DOE-Sponsored Safety Inspection by DOT/NHTSA.
- DOE-Sponsored Safety Compliance Testing by the Research Division of DOT/NHTSA.
- DOT/NHTSA Safety Compliance Test (independent of DOE).

One important principle followed by DOE during testing is to allow the Test Facility Manager to work with manufacturers to overcome the normal problems that occur during the test sequence, limits have been set for the Test Facility Manager concerning how many vehicle component or subsystem failures can be allowed before certification is invalidated. DOE will objectively evaluate the impact of all failures during the testing phase so that vehicles are not unfairly penalized for minor and easily correctable failures. The Test Facility Manager, however, has an obligation to conduct the testing thoroughly and to adhere to a tight schedule.

Manufacturers may be notified from time to time by the Test Facility Manager of potential and actual problems. When these problems do not involve component or subsystem failures, where failure is defined as a vehicle being below the required standard, such notification would not necessarily invalidate the certification.

TEST FACILITY SCHEDULING GUIDELINES

Vehicles will be scheduled for testing by the Test Facility Manager on a first-come, first-served basis, with certain exceptions as noted below. Scheduling is dependent upon the ability of the manufacturer to provide a vehicle for testing. The Test Facility Manager will request the manufacturer to provide a certified vehicle for testing within 60 days from the date of the request. If a vehicle is not received at the Test Facility within the 60-day period, the self-certification will be returned and the vehicle will be removed from the self-certification list.

The primary function of verification testing is to ensure that vehicles available to the Market Demonstration Program fully satisfy the applicable DOE Performance Standards. For this reason, it is necessary to establish a set of priority testing categories for vehicles selected or being considered for selection by demonstration site operators. The categories are listed below in decreasing order of priority for testing:

1. Certified vehicles which have not been verified but have been purchased by and delivered to site operator.
2. Certified vehicles purchased by but not delivered to site operators for demonstration.
3. Certified vehicles that have been modified subsequent to verification testing and have been delivered to site operators. On request by DOE, the manufacturer will furnish DOE with technical information about each modification in sufficient detail to determine if verification tests are needed. (The manufacturer is responsible for notifying the DOE Director of the Electric and Hybrid Vehicle Division or his designee of all modifications to the production configuration.)
4. Certified vehicles that are being considered for purchase by a site operator.
5. Certified vehicles that are available for test but are not under consideration by a site operator.

Vehicle test schedules are sensitive to the requirements of the Market Demonstration Program, and rescheduling by the Test Facility Manager may be required to meet changing needs. Vehicles delivered late or taken out of test because of operational failure may be rescheduled on a lower priority basis by the Test Facility Manager with approval of the DOE Test Manager. On-site rectification of a vehicle problem by the manufacturer within a 5-working-day period described below avoids the necessity for rescheduling.

VEHICLES MODIFICATION/REPAIR GUIDELINES

The guidelines provided in this section are for use by the Test Facility Manager. Exceptions to these guidelines require the approval of the Director of the DOE Electric and Hybrid Vehicles Division or his designee. The intent of these guidelines is to facilitate the establishment of a clear basis for validating a manufacturer self-certification. Subsystem failures may raise questions as to the relevance of the results of the validation testing. It is also important that the test facilities not be used for development and test engineering. Vehicles that experience repeated failures of the same component or subsystem must be upgraded before verification testing can be rescheduled. Rescheduling will be contingent

on the submission and acceptance of evidence obtained by the manufacturer through testing that the cause of failure has been corrected. The Test Facility Manager will determine when significant repairs should be and have been made.

VEHICLE MODIFICATIONS/REPAIRS ON OR NEAR THE TEST FACILITY

1. Only those modifications or repairs that can be completed within 5 working days by the manufacturer or his designee will be allowed. If repairs cannot be completed within this period, the vehicle must be removed from the test facility unless DOE programmatic requirements dictate that it is in the best interests of the Government that a waiver be granted by the Director of the Electric and Hybrid Vehicles or his designee.

2. All failures requiring repair, whether significant or insignificant, will be recorded by the Test Facility Manager or his designee. For all repairs, the manufacturer must submit (to the Test Facility Manager) written explanation of the failure modes and the corrective action taken within 15 days after completion of corrective action. Failed components or subsystems must be replaced by an identical part except in those cases where the component or subsystem design is adequate. In the latter case, the manufacturer may substitute a readily available component or system when the manufacturer can provide assurance or improved reliability and performance.

3. Three on-site repairs to correct a significant powertrain failure are allowed. A fourth failure will invalidate the vehicle certification, and the Facility Manager will order the vehicle to be returned to the manufacturer unless DOE programmatic requirements dictate that a waiver be granted by the Director of the Electric and Hybrid Vehicles Division or his designee.

4. Subject to overriding priority considerations, testing will be resumed as soon as repairs are completed.

VEHICLES RETURNED TO THE MANUFACTURER BECAUSE OF FAILURE IN TEST

1. A letter invalidating the certification will be issued to the manufacturer, and DOE will notify site operators of the invalidation. A report including the vehicle failures will be provided by DOE to members of the public requesting such a report. Vehicles that are part of the Market Demonstration Program (based on the manufacturer's self-certification) which fail the verification tests will have their certifications invalidated until successful correction of the defects is completed. Future funding to site operators for the invalidated vehicle model will be suspended until corrections are completed.

2. A one-time voluntary withdrawal of a vehicle from test by a manufacturer to correct a problem is allowed for a period not to exceed 60 days. The vehicle will be re-scheduled for testing based on priorities at the time of resubmittal. No action will be taken to invalidate the certification during the voluntary withdrawal period unless there is a clear case of user safety involved or the manufacturer fails to offer the vehicle for test after 60 days.

3. Before a vehicle can be resubmitted for testing, the manufacturer must provide to the Director of the Electric and Hybrid Vehicles Division, or his designee, appropriate evidence that modifications and/or repairs have been made. The manufacturer must also provide substantiating test data to show that the vehicle can meet all DOE Performance Standards.

4. Repaired vehicles returned by the manufacturer may be required to undergo the complete series of verification tests regardless of the portion of testing completed prior to invalidation of certification. The Test Facility Manager with the approval of DOE will determine the necessity for such retesting.

GROUND FOR INVALIDATING CERTIFICATION

1. A vehicle will be returned to the manufacturer after four significant powertrain failures or a single powertrain failure that cannot be corrected, and its certification will be invalidated.

2. A vehicle that fails to meet applicable DOE Performance Standards will have its certification invalidated. (The standards include documentation and warranty provisions.)

3. A vehicle that fails to comply with applicable DOT/NHTSA Safety Regulations will have its certification invalidated.

4. If a manufacturer fails to commit to and follow a reasonable schedule (defined in the following section) to provide a vehicle for testing when requested by DOE, the vehicle will have its certification invalidated.

SUMMARY OF RESPONSIBILITY OF MANUFACTURERS

Manufacturers must self-certify their production vehicles to participate in the DOE Market Demonstration Program. They must also commit to a reasonable schedule to provide a vehicle for verification testing upon request from the DOE-designated Test Facility Manager. If this delivery cannot be made within 60 days after receipt of such a request, the self-certification letter will be returned and the vehicle will be removed from the self-certified list.

Manufacturers must provide required and necessary information to document the vehicle configuration:

- Vehicle Summary Data Sheets,
- Operator's Manual, and
- Service and Maintenance Manual including a parts list.

This information may be in draft form, but it must be complete enough to be useful should any mechanical or electrical difficulty develop in the vehicle.

The manufacturer will notify the Director of the Electric and Hybrid Vehicles Division or his designee of all modifications to previously verified production configurations within 30 days of the sale of such modified vehicles to DOE site operators. If it is requested, the manufacturer shall furnish the DOE Test Manager with technical information about each modification in sufficient detail to determine if reverification tests are needed.

For vehicles receiving an invalidation of certification, the manufacturer must provide to the Director of the Electric and Hybrid Vehicles Division appropriate evidence that modifications and/or repairs have been made and must also provide substantiating test data to show that the vehicle can meet all DOE Performance Standards prior to resubmittal of the vehicle for test. Following successful verification testing, vehicles already in DOE site operator fleets must be modified and/or repaired in the same manner as the vehicle successfully tested. A modification and/or repair schedule acceptable to the Director of the Electric and Hybrid Vehicles Division must be developed and followed by the manufacturer as a condition for validation of the manufacturers certification.

DOE NOTIFICATION DOCUMENTATION

DOE will notify manufacturers of actions taken during the verification testing process, including but not limited to:

- Receipt of self-certification.
- Notification of vehicle failure.
- Validation or invalidation of certification.
- Final test report.

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